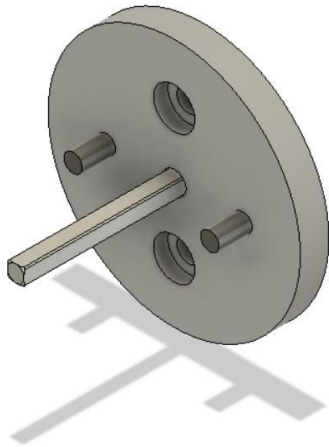
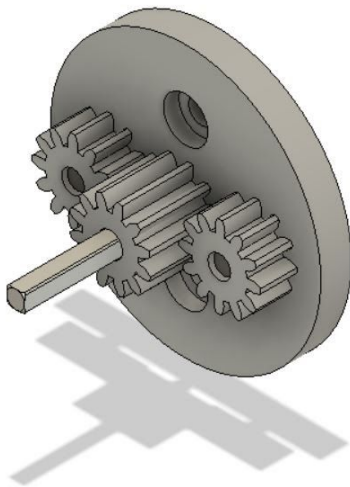


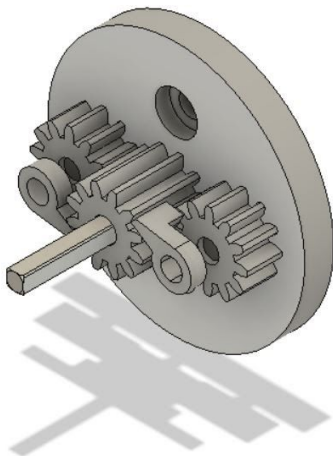
Planetary 2-Way Ratchet Components



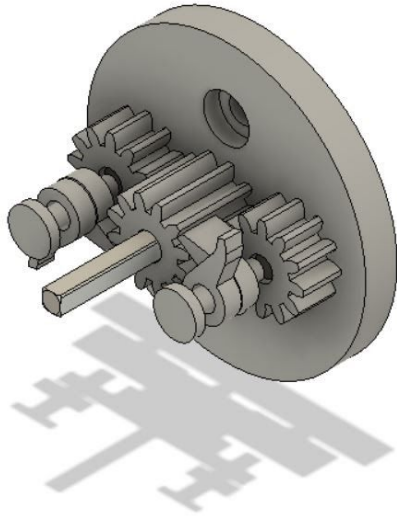
Planetary Bracket and Shaft. The bracket is stationary while the shaft rotates freely. There are screw holes to attach the bracket onto something stationary.



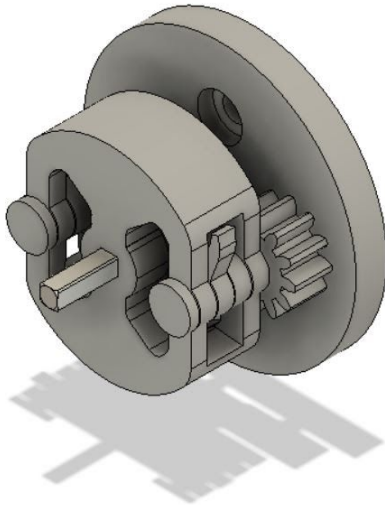
Two Half Small Gears and Full Small Gear. The half gears are planet gears that rotate freely on the planetary bracket. The full gear is the sun gear.



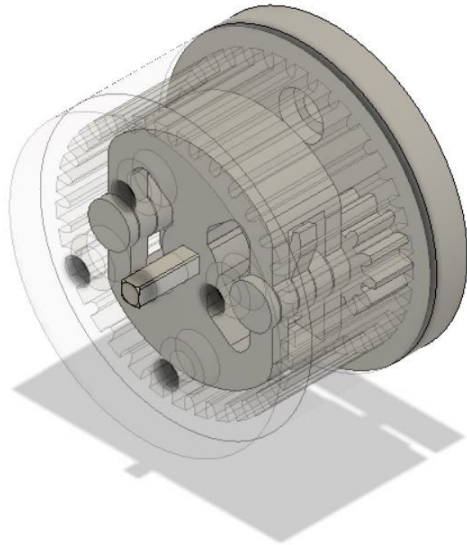
Inner Pawls. These engage with the small gear.



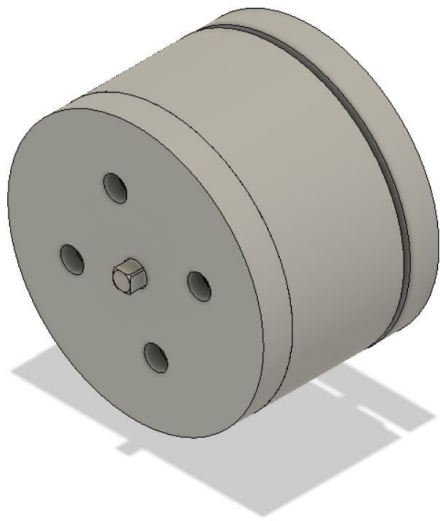
Outer Pawls and Pins. The outer pawls engage with the ring gear, and the pins hold all the pawls in place.



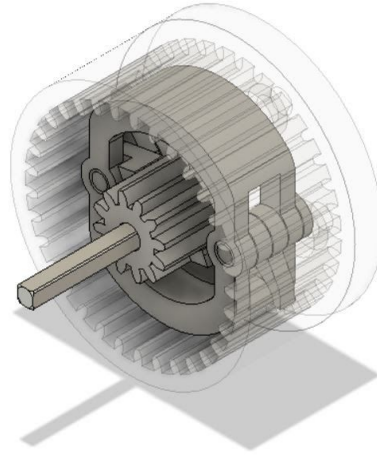
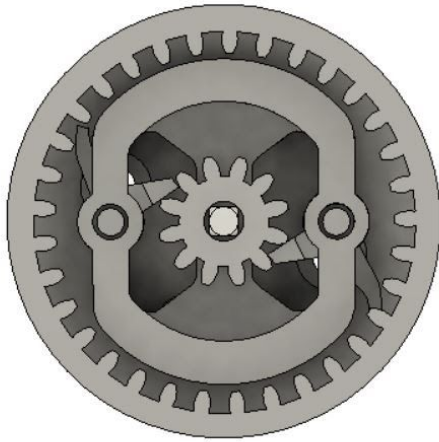
Inner Ring. This holds the pins in place and powers/is powered by the shaft (depending on the pawl orientation). This part is also where you tie the rubber bands that cause the pawls to engage.



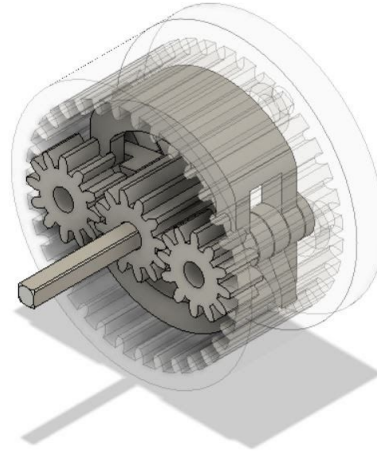
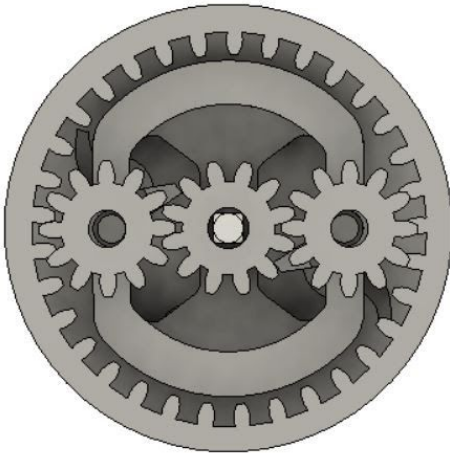
Ring gear. This rotates free around the axle and has screw holes so that you can attach it to the input/output. This powers/is powered by the planet gears. The outer pawls engage with this gear when spinning in the correct direction.



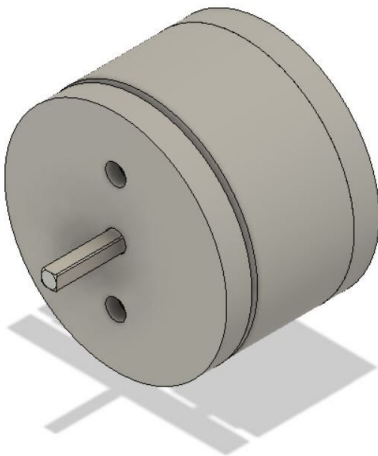
Assembled part



The inside and outside pawls engage with the small gear and ring gear respectively when rotating in the proper direction.

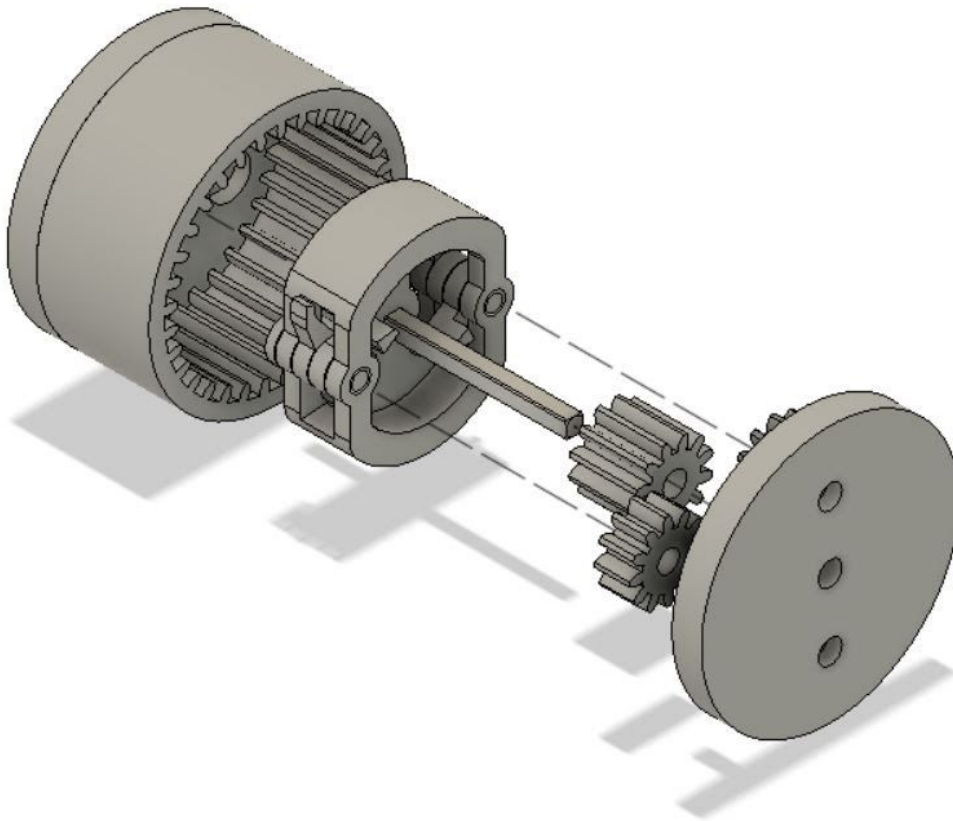
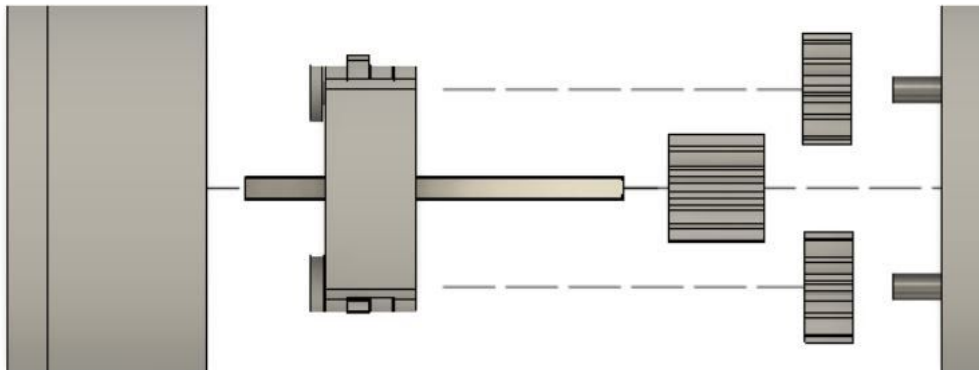


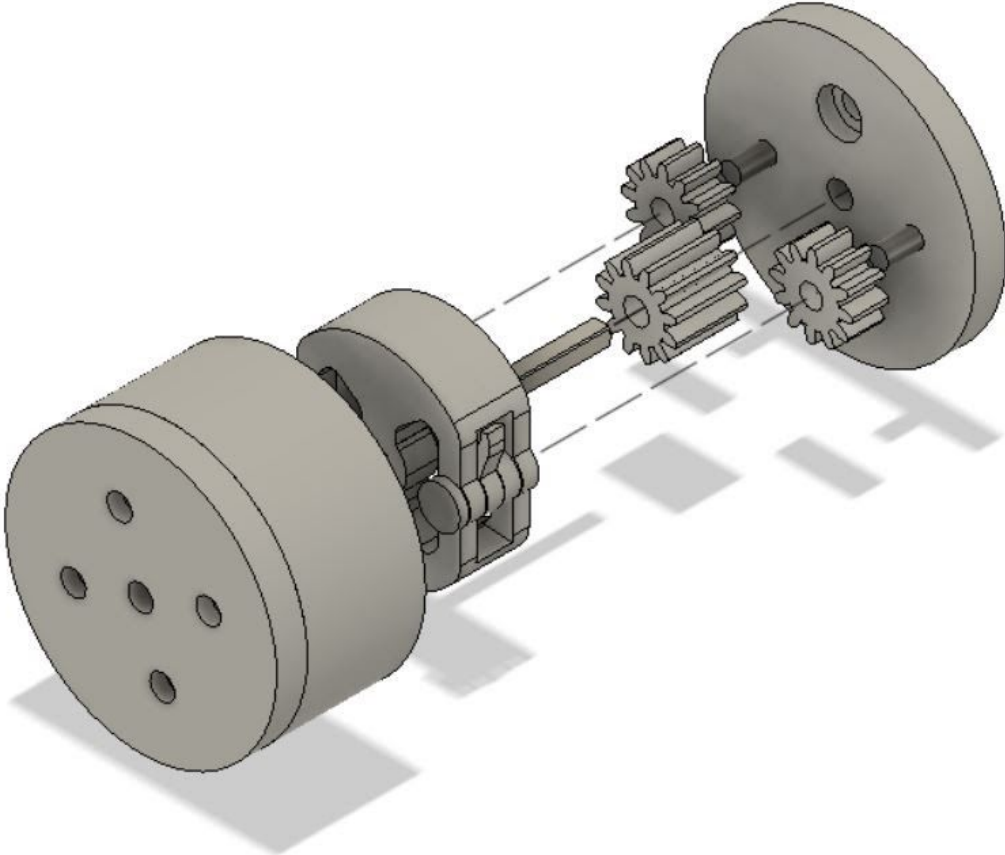
The ring gear and small gear always spin in opposite directions. The small gear always spins faster than the ring gear.



Assembled part

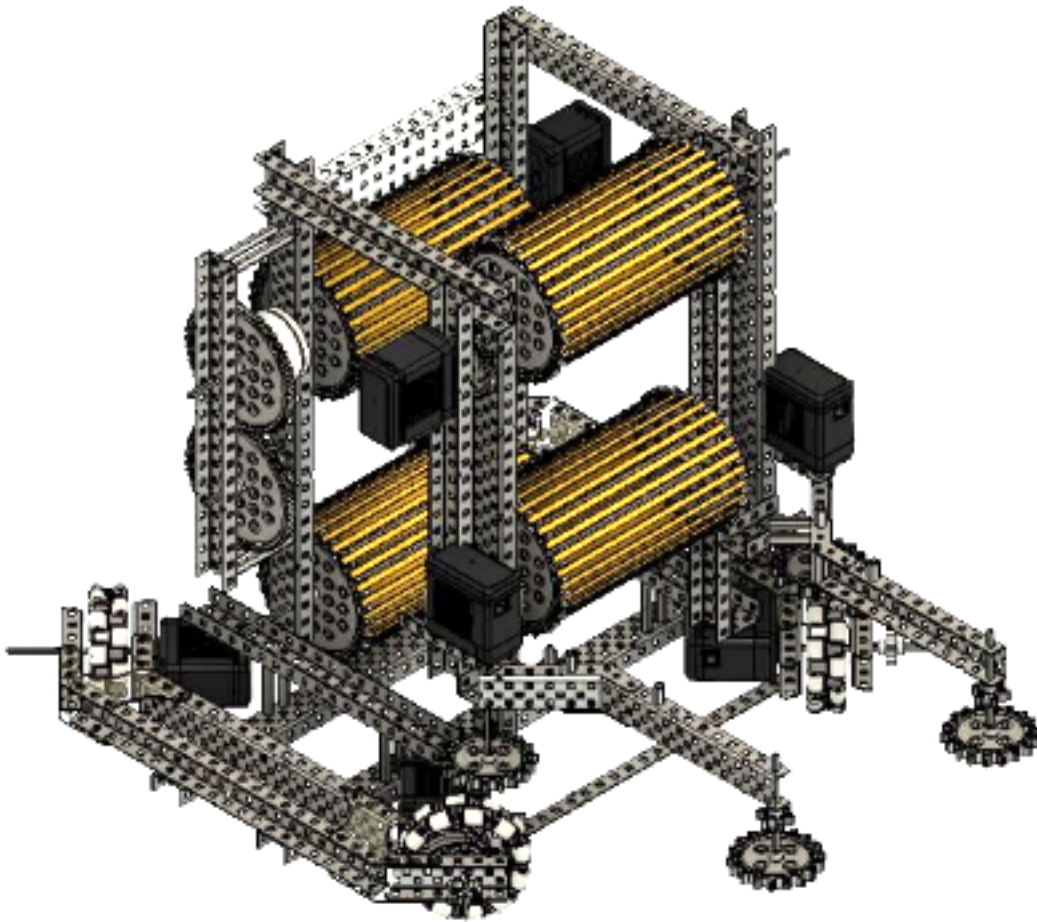
Exploded Views





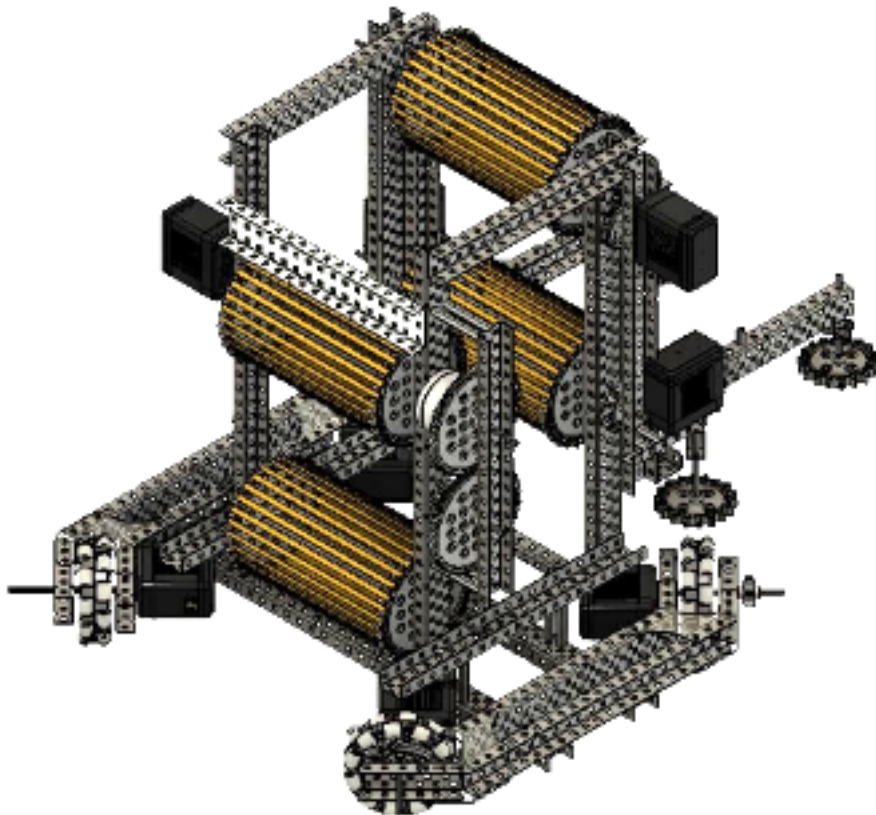
Part on Robot

Note: see video for a demonstration of part on the physical robot



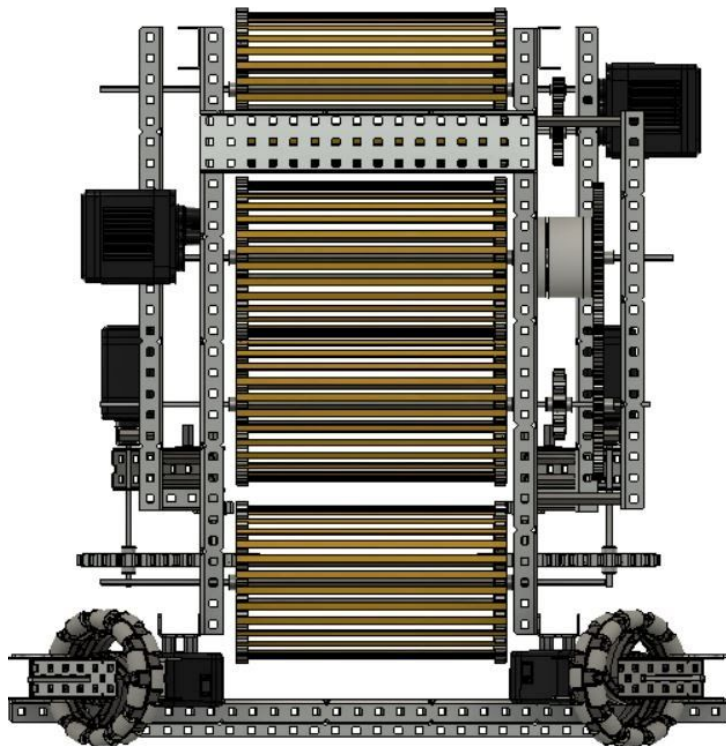
Front Right

view of the robot. The planetary 2-way ratchet allows the bottom front and top back rollers to be run by the same motor. For blue balls, the bottom front roller spins clockwise at $\frac{1}{3}$ speed, and the top back roller spins clockwise at full speed. For red balls, the bottom front roller spins clockwise at full speed, and the top back roller spins counter-clockwise at full speed.

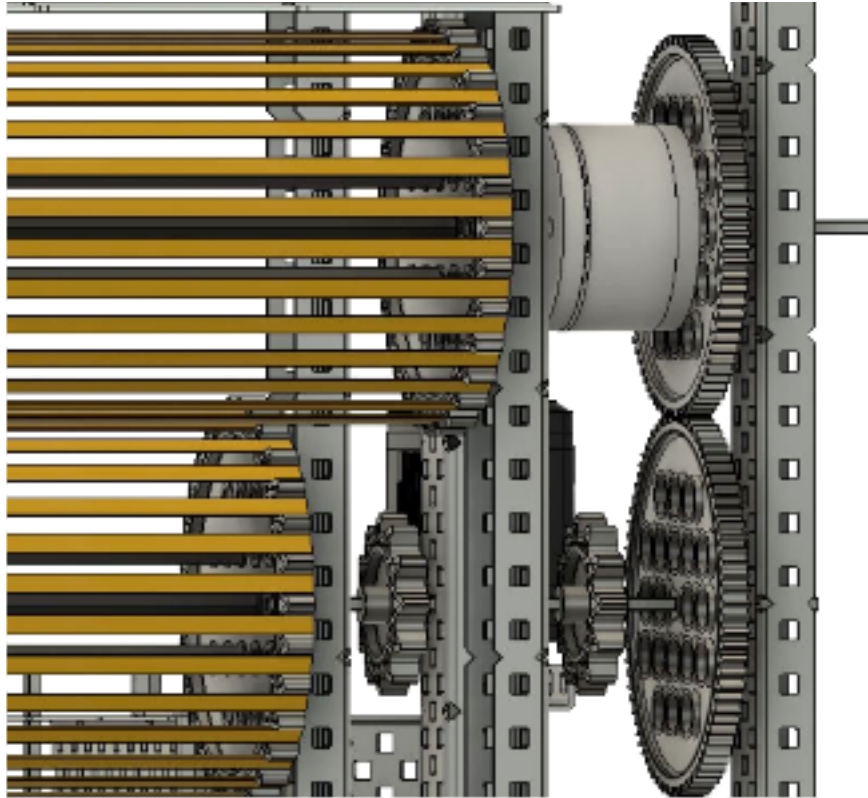


robot

Back Right View of the



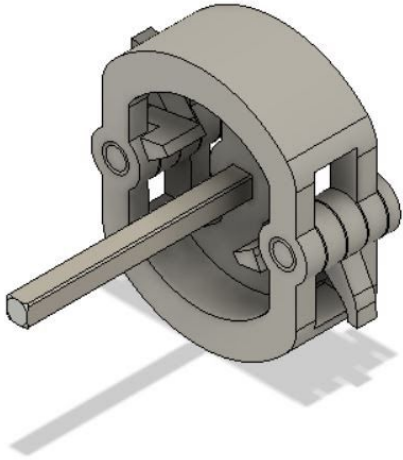
Back view of the robot



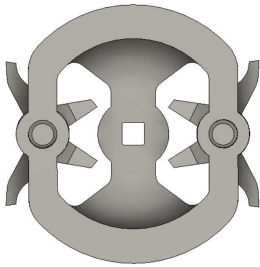
the robot

Back Zoomed-In view of

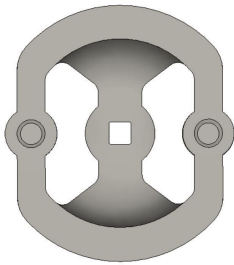
Inner Ring Pawl Arrangements



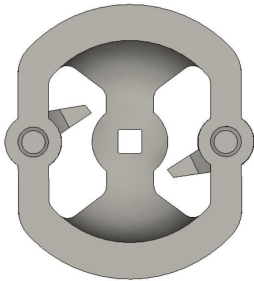
Inner Ring with Pawls



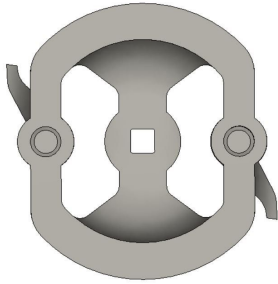
Each pin can hold 2 pins. This shows all the scenarios in which the pawls can be arranged. This allows for multiple uses for the same part.



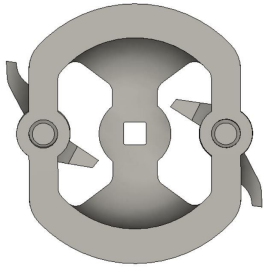
No pawls. Shaft and ring gear spin freely from one another.



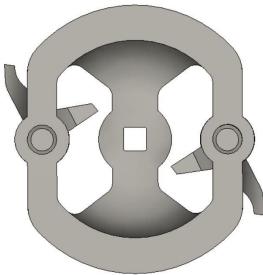
Inside pawls only. This works like a normal ratchet. However, the planetary gear system allows for a 3:1 or 1:3 gear ratio.



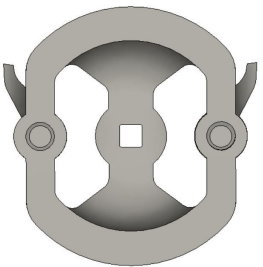
Outside pawls only. This works like a normal ratchet.



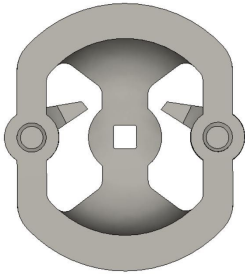
This is the configuration that we used in our demonstrations. Both inside and outside pawls. The inside pawls engage when spinning in one direction while the outside pawls engage when spinning in the other direction. When the inside pawls engage, there is a 3:1 gear ratio. The input is the shaft and the output is the ring gear.



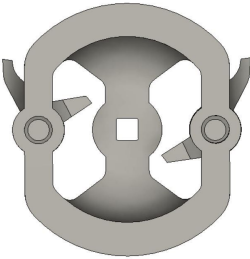
Both inside and outside pawls. The inside pawls engage when spinning in one direction while the outside pawls engage when spinning in the other direction. When the inside pawls engage, there is a 1:3 gear ratio. The input is the ring gear and the output is the shaft.



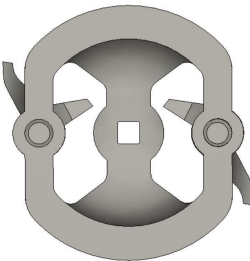
Shaft and ring gear spin freely together.



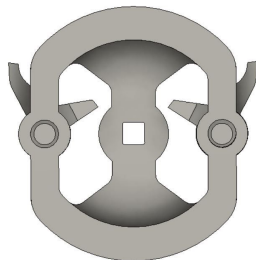
Shaft and ring gear spin freely together. The planetary gear system allows for a 3:1 or 1:3 gear ratio.



This works like a normal ratchet. However, it cannot spin backward

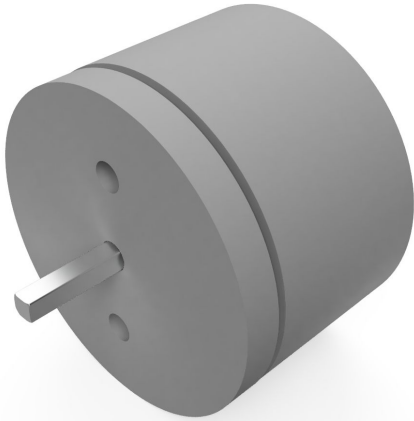


This works like a normal ratchet. However, it cannot spin backward, and the planetary gear system allows for a 3:1 or 1:3 gear ratio.



Static lock. Nothing spins.

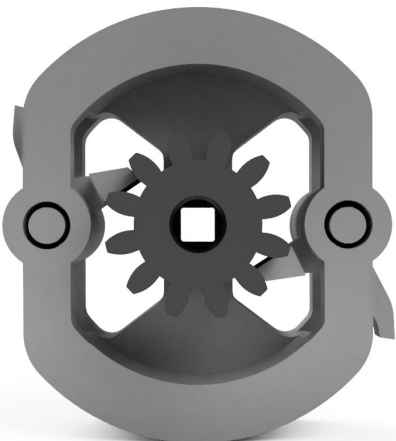
Renderings



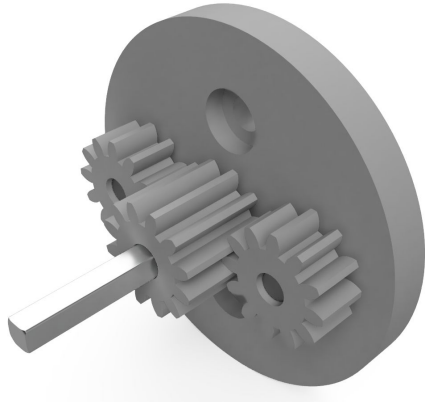
Assembled Part



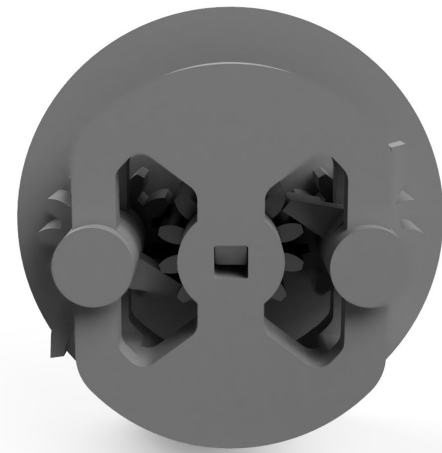
Inside Ring/Pawls and Ring Gear



Inside Ring/Pawls and Small Gear

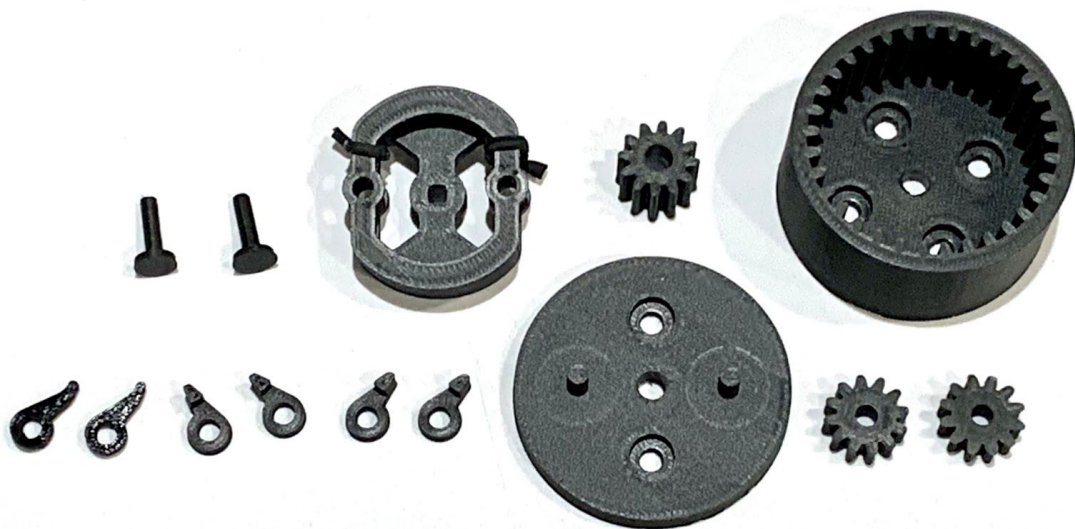
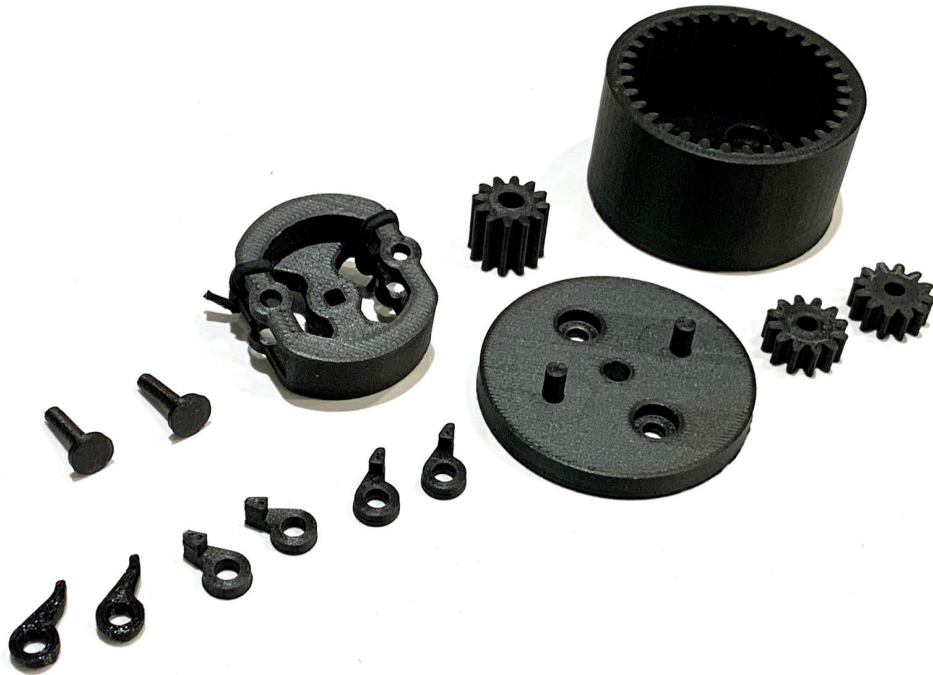


Planetary Bracket with Small Gears



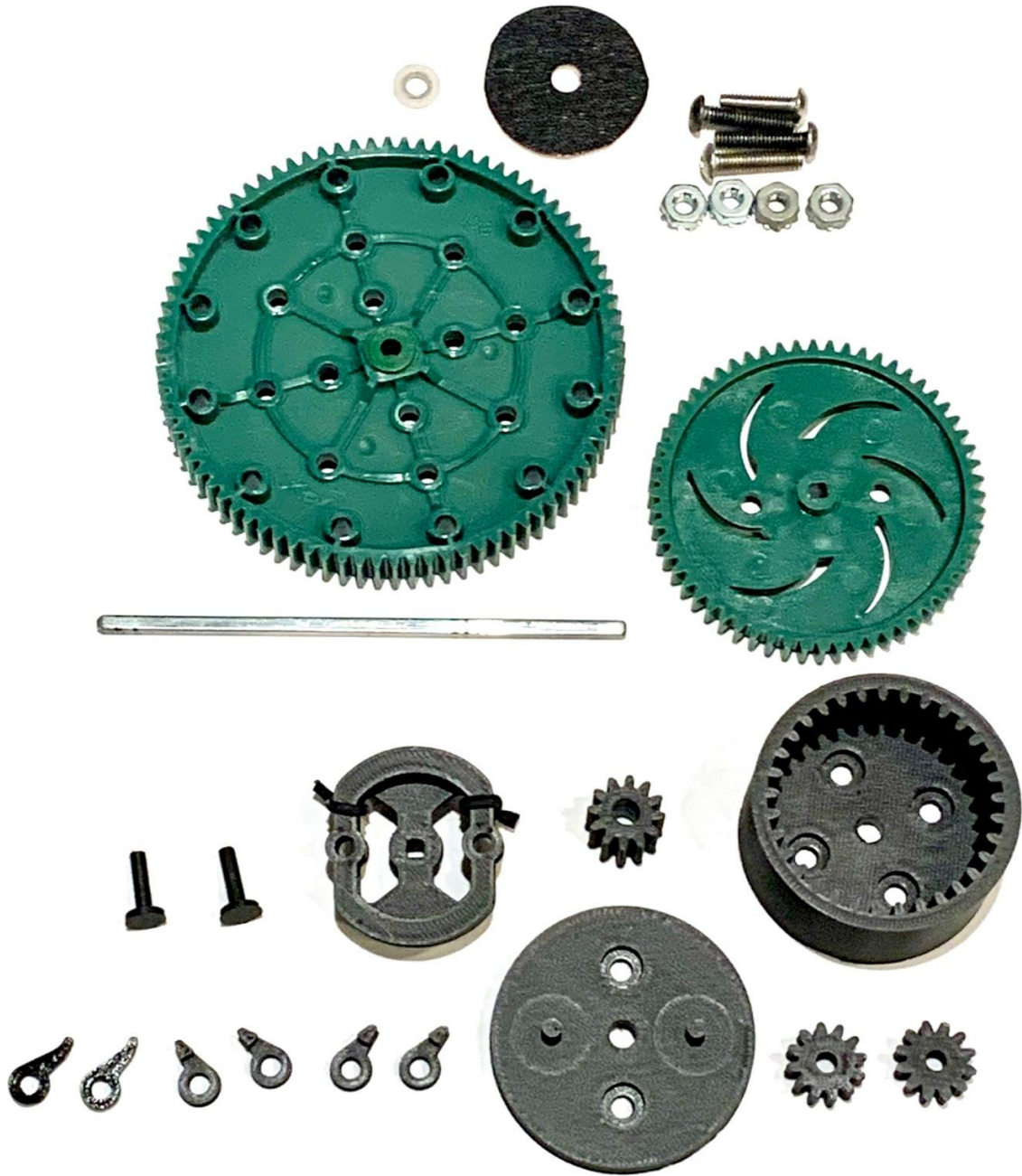
Planetary Bracket with Small Gears and Inside Ring/Pawls

Physical Components



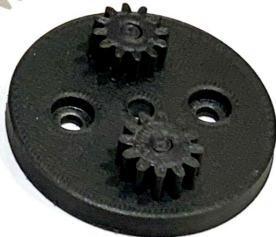
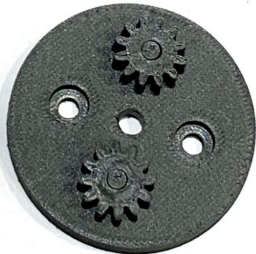
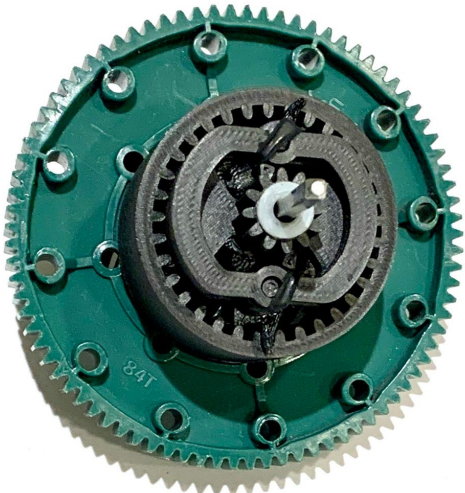
3D

Printed Parts. These were printed on our school's onyx and carbon fiber after prototyping on the Makerbots.

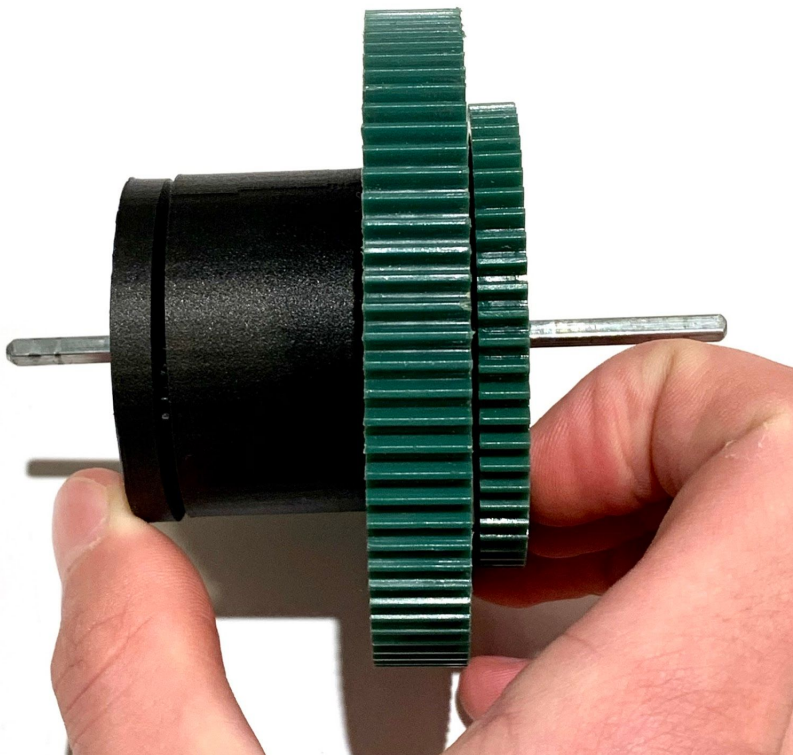
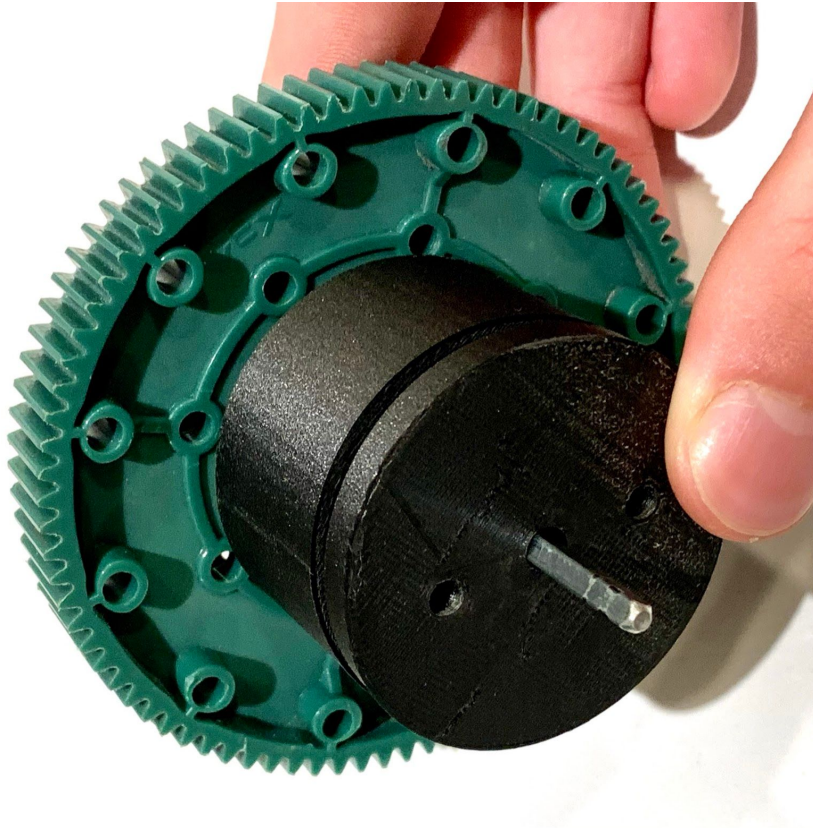




All parts used in the planetary 2-way ratchet. 3D printed parts are at the bottom, and VEX parts are at the top. There are also custom rubber bands on the inner ring and a cardboard spacer at the top.



Partially assembled part.



Fully assembled part. The gears are for demonstration and can be replaced with other VEX Parts.